Section 6: Planning

Introduction – What is planning?

Encompassing many aspects of civil design and construction, "planning" means making informed decisions based on a complete knowledge base, taking into account past and future models of development and societal trends.

In the case of a Comprehensive Plan, a "complete knowledge base" will include both objective information (maps and population/demographic data) and subjective information (public opinion surveys and responses at town meetings). Town planners and local citizens alike will find the GIS-type system both functional in terms of a communication device, and appealing in terms of a human-to-computer interface.

A Comprehensive Plan will serve two groups in the community, "leaders and residents". It will be used as a "guiding light" for planners and town leaders to "stay the course" in their efforts to better the community and the town in which they themselves live. The Plan will offer a resource to look back upon, and a base on which many future decisions will be formed. For the "livers", or the residents of the jurisdiction, the Plan will keep them abreast of community plans and long-term values and objectives their leaders have set for the area. It will allow them to form opinions on design trends and future zoning patterns, and most importantly, to communicate their opinions and wishes to their decision makers in an efficient and organized fashion.

Other areas of municipal management have applications in GIS as well. The zoning/rezoning process can be computerized with GIS, allowing citizens and planners alike to access zoning variance submissions and zoning ordinances. Municipal planners would be well served to have access to historical structure (and historical area) data. Historical structures cannot be cleared to make room for new development, so other provisions would have to be made. To have this data incorporated into a GIS would be a large help to the planning process.

Transportation planning and maintenance is an industry of its own, but this data, too, can be integrated into a GIS; it can be either *Inter-* or *intra*net based. Planning for construction of a road or other transportation system requires a vast amount of spatial data, including existing roads, topography (contour lines), hydrology (creeks and rivers), existing tax parcels, and existing structure footprints. Other data (like drainage features and zoning maps) may prove to be extremely helpful in the process of planning a new road alignment. All this data can be hosted and served by a GIS; this centralizes all data, making the process of data access extremely efficient.

A) Historic & Cultural Inventory/Preservation

1) Spatial Data
   a) Minimum Requirements
      - Tax parcel mapping
      - Historical markers and structures
      - Historical district boundaries
      - Historical area maps/National Parks
   b) Optional Requirements
      - Road maps of jurisdiction
      - Digital orthophotography
      - Recreation locations
      - Cemetery sites
      - National Park boundary information

2) Attribute Data
   a) Road maps
      - Minimum Requirements
         - ⇒ Road type
         - ⇒ Road name
      - Optional Requirements
         - ⇒ Construction material
         - ⇒ Length of segment
         - ⇒ Year built
         - ⇒ Year last paved
         - ⇒ Number of cars/minute (average)
   b) Tax Parcel Maps
      - Minimum Requirements
         - ⇒ Unique parcel identifier (tax map number, GPIN, etc.)
         - ⇒ Zone type
      - Optional Requirements
         - ⇒ Owner name
         - ⇒ Owner address
         - ⇒ Property address
         - ⇒ Deed Book/Page
         - ⇒ Plat Book/Page
         - ⇒ Land value
         - ⇒ Structure value
         - ⇒ Total value
         - ⇒ Age of structure(s)
         - ⇒ Number of structure(s)
         - ⇒ Acreage
         - ⇒ Date last assessed
         - ⇒ Date last surveyed
   c) Point Data (historical markers, structures, etc.)
      - Minimum Requirements
         - ⇒ Feature name
      - Optional Requirements
         - ⇒ Admittance fee
         - ⇒ Parking fee
         - ⇒ Feature type (marker, structure, etc.)
         - ⇒ Number of structure(s)
         - ⇒ Age of structure(s)
         - ⇒ Type of construction (bridge, house, etc.)
         - ⇒ Construction material (wood, stone, etc.)
         - ⇒ Year built (or year event occurred for an historical marker)

⇒ Person(s) involved with structure or event (ex. General Robert E. Lee)

d) Historical Area Maps
- Minimum Requirements
  - ⇒ Area name
- Optional Requirements
  - ⇒ Admittance fee
  - ⇒ Parking fee
  - ⇒ Number of structure(s)
  - ⇒ Age of structure(s)
  - ⇒ Type of construction (bridge, house, etc.)
  - ⇒ Construction material (wood, stone, etc.)
  - ⇒ Year built
  - ⇒ Person(s) involved with area (ex. General Robert E. Lee)

3) Data Acquisition Options

a) Road mapping
- Acquire from Virginia Department of Transportation (limited availability) or from a third party vendor

b) Orthophotography sources
- VGIN's VBMP imagery
- USGS orthophotography (DOQs)
- Aerial photography from a third party vendor

c) Tax mapping
- In-house
  - ⇒ Scan hardcopy tax maps and geo-reference them, according to the coordinate system chosen
  - ⇒ On-screen (heads-up) digitization of parcel boundaries relative to tax maps
    (i) Quick, but less accurate than using Coordinate Geometry (CoGo)
  - ⇒ Entering each parcel boundary into CAD/GIS software using deed books and property descriptions
    (i) Extremely accurate, but time-consuming and expensive
  - ⇒ More information can be found in the Finance/Tax Mapping section
- Contract with third party vendor for digitization work

d) Point data (historical markers, structures, etc.)
- USGS, National Park Service, field checks, archaeological societies, etc.

e) Historical area maps
- USGS, National Park Service, field checks, archaeological societies, etc.

f) Other data
- Acquire from owner or manager of such data and scan/digitize and conflate to orthophotography as necessary.

4) Data Conflation Options

a) Orthophotography
- Verify that all digital orthophotography image chips to cover the county or interest area are accessible (if applicable).
- Use CAD/GIS software to mosaic all image chips into one complete image, for ease of use.

b) Tax Parcel Mapping
- Conflate the tax parcel boundary data to the orthophotography, using the imagery as a reference rather than as a determiner of absolute property location. A real estate database can be used to check property addresses against existing E-911 street address mapping.
- Maintain relative parcel size, geometry, and orientation within a section map.

c) Zone Mapping
- Conflate zone mapping to the orthophotography, again, using the imagery as a reference rather than as a determiner of absolute zone location.

d) Point Data (historical markers, buildings, etc.)
- Manually conflate the point data to the digital orthophotography.

e) Historical area maps

- Manually conflate the historical area maps to the digital orthophotography.

5) GUI/Programming Options
   a) GIS-type interface for easy and efficient accessibility.
6) Internet Functionality and Options
   a) From an Internet standpoint, all mapping information (both required and optional, if applicable) could be integrated into one GIS-type interface that could be available 24 hours a day.
   b) All GUI/Programming Options listed above could be made available online so the citizens of your jurisdiction can access and view them.
   c) Could be used by local citizens, area visitors stimulating the local tourism industry.
   d) Could also be useful to planners as historical sites restrict development.
7) Technical Requirements
   a) Minimum Requirements
      - 400-MHz
      - 2-GB hard drive
      - 256-MB RAM
      - 15" monitor
      - CAD/GIS software
      - Scanner (if electing to digitize in-house)
      - Internet connection (for downloading data, if applicable)
   b) Optional Requirements
      - A faster machine will make work quicker; listed above is absolute minimum
      - 850-MHz or above recommended
      - 20-GB hard drive for increased storage space
      - 512-MB RAM for faster regeneration and manipulation of data
      - 17" or 19" monitor for increased screen resolution (and larger viewing area)
8) Administrative/Management Requirements
   a) During development
      - Public meetings
      - Public opinion surveys
      - Complete inventory
      - Plan development
      - Plan acceptance
   b) After deployment
      - Scheduled reviews/revisions
      - Implementation
      - Made available online or hardcopy

9) Cost – Cost/Benefit
   a) In-house
      - GIS technician - $8-$14 per hour
      - Project manager - $16-$20 per hour
      - Note: in-house costs do not include benefits or overhead
   b) Contracted
      - GIS technician - $30-$50 per hour
      - Project manager - $55-$70 per hour
   c) Schedule:
      - Tax maps need to be converted to digital:
        ⇒ Using the following items from the Schedule section, we can estimate a cost per tax map sheet for digital work.
          (i) Scanning (10 minutes per sheet)
          (ii) Digitization (3 hours per sheet)
          (iii) Annotation (1 hours per sheet)
          (iv) Conflation (8 hours per sheet)
          (v) Edge-matching (1 hour per sheet)
          (vi) Total time per sheet is *about* 13-14 hours.

- ⇒ A typical Virginia county is comprised of about 100 tax map sheets. Larger counties will include more; small counties will include fewer.
- ⇒ Therefore, an average county will require about 1300-1400 hours to complete the digital parcel mapping tasks listed above, or about $10,000 to $20,000 if done in-house.
- ⇒ These are average estimates; time for any given tax map (or even an entire jurisdiction) will vary greatly. Use the scale bar on each of your tax maps to determine how many encompass the area you desire.

- Tax maps are already in digital form:
  - ⇒ Estimate how many historical markers exist in the county and multiply this figure by .017 ($1/60^{th}$ of an hour) to estimate the total number of hours needed to conflate this data to the orthophotography.
  - ⇒ Estimate how many historical/archaeological areas exist in the county and multiply this figured by .083 ($5/60^{th}$ of an hour) to estimate the total number of hours needed to conflate this data to the orthophotography.

d) Benefits of a GIS
- A GIS provides a powerful, logical, and intuitive means to store, manipulate, and retrieve data.
- It can maintain, analyze, and report on geographic data such as points and symbols, lines and curves or polygons, and attribute data such as characters, numbers, and dates.
- A GIS provides the ability to see on screen or in map form, only those features or objects that meet specific selection criteria.
- In an instant, you can visually identify features in a geographic representation that would take much longer to find (and modify if needed) in a printed report.

10) Standards/Guidelines Summary

a) Spatial data
- Geographic data you want to see, such as road maps, zoning maps, land use maps, tax parcel maps, buildings and structures, etc.

b) Attribute data
- Database information behind the visual data. Includes real estate database information, linked to tax and zoning maps and other attribute data for other forms of spatial data.

c) Data acquisition
- Where and who you will get your data from.
- Most data is available from other governmental or municipal agencies, like Commissioner of Revenue's Office, Virginia Department of Transportation, etc.

d) Data conflation options
- Geometrically matching your new data to your existing data.
- Establish a "base map" for your system (digital orthophotography for example) and correct all other maps to coincide with the aerial photos.

e) GUI/programming options
- How you can work with your data; includes custom database interfaces, possible Internet interfaces, review/revision provisions, etc.

f) Internet functionality options
- How you can put your data on the Internet (and its uses thereafter).
- Examine current examples on the Internet.
- Conduct public opinion surveys to discover what your citizens would like to see in your online system.
- Items listed here are merely examples.

g) Technical requirements
- What you will need to acquire, manipulate, and store your data.
- Listed here are absolute minimums. Faster machines will increase efficiency.
- In this case, "the faster the better."

h) Administrative requirements
- Administration processes before and after system deployment.
- Listed (but not limited to) are tasks involved with setting up your system; includes working with other agencies, working with the public, advertising your system, and other tasks.

i) Cost – cost/benefit
- Costs associated with this work, and benefits of them.
- Pay rates of your in-house employees are lower than paying a vendor's employee time, but these rates do not include your jurisdiction's benefits package nor your overhead costs (for utilities, computer equipment, etc.).

11) Startup Procedures/Steps

a) Digitization
- On-screen (heads-up) digitization:
  - ⇒ Scan each hardcopy map.
  - ⇒ Digitize all boundary lines in CAD/GIS software, including all historical and archaeological site boundaries and limits.
- If Coordinate Geometry (CoGo) information is available for a site or area:
  - ⇒ Enter boundary lines into CAD/GIS software using Coordinate Geometry (CoGo) and property descriptions.

b) Annotation
- Using hardcopy maps or other information source, annotate all areas with the attributes desired (name, entrance fees, etc.).
- Keep text insertion points in the centers of polygons, for ease of reading and for ease of database creation and linking after the data is ready.
- Minimum annotation needed:
  - ⇒ Area name
- Optional:
  - ⇒ Dimensions
  - ⇒ Acreage
  - ⇒ Entrance/parking fees

c) Conflation
- Verify that all digital orthophotography image chips to cover the county or interest area are accessible.
- Use CAD/GIS software to mosaic all image chips into one complete image, for ease of use.
- Conflate the tax parcel boundary data to the orthophotography, using the imagery as a reference for location of boundary lines of each historical or archaeological area.
- Maintain relative size, geometry, and orientation of said area when conflating to orthophotography.

d) Edge-matching (if multiple tax maps are involved)
- Parcels or regions that encompass multiple tax map sections must share agreeable boundaries.
- A parcel or area boundary has given metes & bounds; this information should agree for a boundary line that splits tax map sections.
- Even if the boundary was conflated, and not entered with CoGo information, boundary lines that cross tax map section lines must still run along the same heading and cross the tax map boundary in the same place on both tax maps.
- Single parcels or regions separated by tax map boundaries should contain one (and only one) unique identifier.

12) Estimated Time Line and/or Implementation Schedule

a) If tax maps need to be converted to digital:
- Scanning (10 minutes) per sheet
- Digitization (3 hours) per sheet
- Annotation (1 hours) per sheet
- Conflation (8 hours) per sheet
- Edge-matching (1 hour) per sheet
- Approximately 13 to 14 man-hours are needed to accomplish the above tasks for each tax map. This is based on a moderately populated area. Variations in population density can shorten or lengthen the time needed to complete all data for a single tax map.

b) If tax maps are already digital:
- Conflate each historical structure, marker, or area to the tax maps and digital orthophotography. Plan on 1 minute per point source and 5 minutes per historical area; these are rough estimates.

13) Best Practice Examples in Virginia
   a) The Town of Blacksburg's Comprehensive Plan (http://www.blacksburg.va.us/comp_plan/) includes historical structure/district layers so planners and visitors can quickly see where in Town these features are.
   b) Cemeteries are usually considered historical sites, and cemeteries themselves can be mapped with a GIS. Blacksburg's Westview Cemetery website: http://arcims2.webgis.net/Blacksburg_cem/.
   c) Wise County, Virginia has historical sites mapped in their GIS, with historical dates, foundation types, builder, etc. http://arcims2.webgis.net/wise/default.asp.